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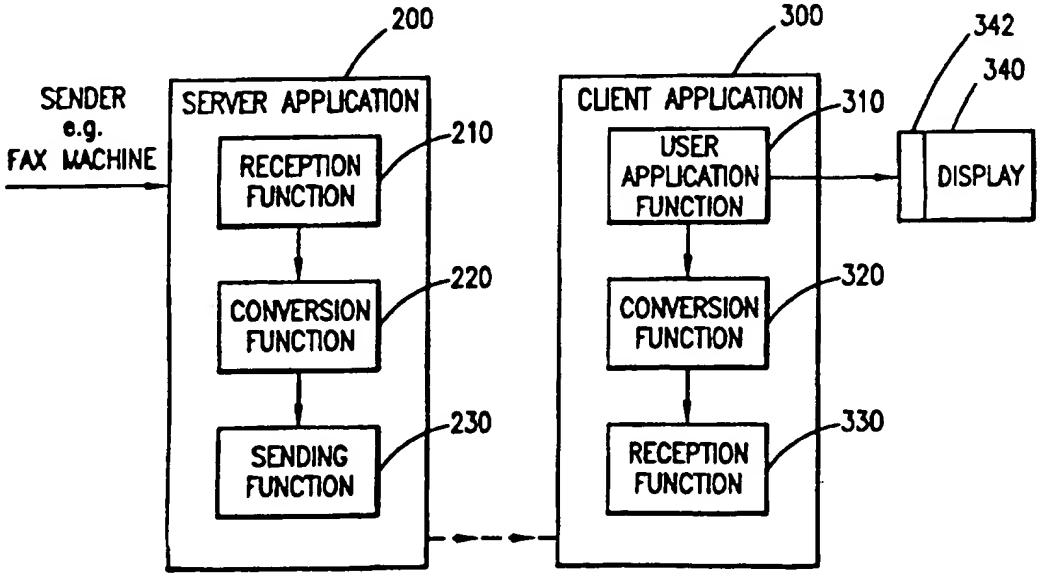

(57) Abstract

Binary data representing graphic images, such as a Graphics Interchange Format (GIF) file, are converted into character based data. The converted character based data are then loaded onto an Unstructured Supplementary Service Data (USSD) message and transported to a mobile terminal via Stand-alone Dedicated Control Channel (SDCCH) provided by the Global System for Mobile (GSM) or Personal Communications System (PCS) network. Once the transmitted USSD message containing the converted character based data are received by the mobile terminal, the encapsulated data are retrieved and reconverted back to the binary data representing the original GIF file. The GIF file is then fed into a video graphics array (VGA) driver to be displayed on a liquid crystal display (LCD) unit attached to the mobile terminal.

SENDING GRAPHIC IMAGES TO MOBILE TERMINALS

BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention relates to a digital mobile telecommunications system and, in particular, to the transmission of graphic images for display by a mobile terminal within a digital mobile telecommunications system.

Description of Related Art

With the advent and development of mobile telecommunications systems, telephone users are no longer associated with physical wires to communicate over a telecommunications network. Because of the mobility and the compactness provided by mobile terminals, mobile telecommunications systems have been very successful and mobile subscribers continue to represent a large and increasing percentage of all new telephone subscriptions around the world.

With the continuing improvement in the display technology, mobile terminals are now equipped with alpha-numeric and graphic displays. Consequently, mobile subscribers no longer have to memorize or associate a calling party with a long series of numbers. A telephone directory number along with a name or label for the party can be stored within a memory device residing in a mobile terminal. Whenever the user wishes to communicate with that particular number, the user can browse the memory and select the pre-stored name for communication.

Furthermore, the Global System for Mobile (GSM) communications and Personal Communications System (PCS) offer a number of sophisticated and flexible subscriber applications to mobile subscribers. One such subscriber

application is an Unstructured Supplementary Services Data (USSD) protocol which provides a container mechanism to transport unstructured or system unrecognizable data (e.g., user specified character messages) to an application within a mobile terminal. USSD utilizes a non-traffic channel for communicating application layer data between a mobile terminal and a Public Land Mobile Network (PLMN). Because no speech connection is required for USSD, a user may use the mobile terminal for a speech connection while an application residing within the same mobile terminal simultaneously receives USSD messages over a separate communications channel.

An example of an USSD application comprises a subscriber feature management system. A mobile subscriber may have subscribed to a number of special subscriber features, such as Call Forwarding, Call Waiting, and Speed Dialing. In a non-GSM or non-PCS environment, the user has to dial the operator or the exchange providing the features and manually activate, deactivate, or modify the features by either speaking with an operator or dialing a series of service codes and subsequently needed subscriber information. However, with GSM or PCS, a user merely has to pull up a menu on the liquid crystal display (LCD) attached to a mobile terminal, scroll down to the appropriate feature entry, and change the state of the selected feature by either activating, deactivating or entering requiring subscriber information without establishing a speech connection with the serving PLMN. The mobile terminal then automatically transmits the updated information via USSD messages toward the PLMN to actually update the state of the selected feature. Another example of an USSD application comprises concurrently communicating user inputted character data

while a user is in speech with another party. These data might comprise directions to a restaurant, advertisements, or other text messages for subscriber consideration while continuing with a speech communication over the separate voice channel.

One known deficiency with the above GSM or PCS system is its inability to transport graphic images such as still pictures, moving pictures, or fax images to a mobile terminal. This is because the USSD is a character based message system. It is standardized to transport character data between a mobile terminal and a PLMN. Graphic images or fax materials instead comprise binary data or bit data which are incompatible with a character based format.

In order to communicate graphic images to a mobile terminal, one solution would be to introduce a different transport mechanism or standards. However, the purpose of GSM or PCS is to standardize the networking environments and protocols to enable mobile users to freely travel and communicate over a number of different mobile telecommunications systems. Therefore, any new protocol or standard must be reviewed and approved by all of the participants in the GSM or PCS environment (or committee). Because the current GSM or PCS standard is the result of long and arduous negotiations between a number of different providers or countries, it is unlikely that a new protocol or mechanism to handle graphic images could be timely developed.

Accordingly, it would be advantageous to transport graphic images to a mobile terminal without modifying the current PCS or GSM protocols or introducing a new transport mechanism or protocol.

SUMMARY OF THE INVENTION

The present invention advantageously provides a system for transporting graphic images to a mobile terminal associated with a mobile telecommunications system using a character based message system. The binary data representing a graphic image are converted into a character based format. The converted character based format data are then encapsulated within character based format messages and transported over to the mobile terminal via a non-traffic communications channel. The mobile terminal reconverts the received character based format data to the original binary data and processes the data for display.

In one aspect, the present invention includes a method and apparatus for transporting graphic images to a mobile terminal by utilizing Unstructured Supplementary Service Data (USSD) messages.

In another aspect, the present invention includes a method and apparatus for transporting graphic images to a mobile terminal by utilizing Short Message Service (SMS) messages.

In another aspect, the present invention includes a method for converting binary graphic image data to character based data and for transporting the data via USSD or SMS messages.

In yet another aspect, the present invention discloses a system where a server application converting binary graphic image data to character data is located within a mobile switching center (MSC) serving a particular mobile terminal.

In yet further aspect, the present invention discloses a system where a server application converting binary graphic image data to character data is located

within a home location register associated with a MSC serving a particular mobile terminal.

In still another aspect, the present invention discloses a system where a server application converting binary graphic image data to character data is located within an external node associated with a home location register serving a particular mobile terminal.

In still another aspect, the present invention discloses a system where received character based messages are reconverted back to the original binary graphic image data and processed for display by the mobile terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be had by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a block diagram illustrating the communication of Unstructured Supplementary Services Data (USSD) messages between a mobile switching center (MSC) and a mobile terminal;

FIGURE 2 is a block diagram illustrating the data format of a USSD message;

FIGURE 3 is a block diagram illustrating the data format of Graphics Interchange Format (GIF) data;

FIGURE 4 is a block diagram illustrating the overview layout of the conversion process for encapsulating binary graphic image data into USSD messages;

FIGURE 5 is a block diagram illustrating the encapsulation of GIF data within an USSD message;

FIGURE 6 is a block diagram illustrating a server application transmitting graphic images to a client application;

FIGURE 7 is a block diagram illustrating a server application residing within a MSC serving a particular mobile terminal;

FIGURE 8 is a block diagram illustrating a server application residing within a home location register serving a particular mobile terminal; and

FIGURE 9 is a block diagram illustrating a server application residing within an external node connected to a home location register serving a particular mobile terminal.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram illustrating the communication of Unstructured Supplementary Services Data (USSD) messages between a mobile terminal 100 and a mobile switching center (MSC) 130. Signaling for telecommunication services is normally performed in a structured way. For example, specific predefined data, formats, and signal names are used to setup a speech connection, to perform handovers, and to authenticate subscriber information when providing telecommunications service to a mobile subscriber. However, with the introduction of the Global System for Mobile (GSM) communications and the Personal Communications System (PCS), a number of new and advanced supplementary services are being provided to mobile subscribers. Since these supplementary services utilize user specified data, there are no structured ways to communicate these data between a Public Land Mobile Network (PLMN) GSM application and a mobile terminal. As a result, a number of unstructured message protocols have been developed for the GSM or PCS environment. One such protocol is the Short Message Service (SMS) protocol for transporting information

between a PLMN and a mobile terminal. Another protocol is Unstructured Supplementary Service Data (USSD) which has been introduced to enable user interaction between GSM PLMN applications and a mobile terminal in a transparent way through the mobile telecommunication network. It is transparent because neither the MSC nor the mobile terminal review or manipulate the contents of the messages being transported.

Accordingly, USSD or SMS is used when structured, functional signaling is not available for a supplementary service. The USSD protocol, for example, provides a transport mechanism for carrying unstructured data (e.g, user specified text data) to and from an application residing within a targeted mobile terminal. One example of such a supplementary service is the registration, deletion, activation, or deactivation of subscriber services. Another example is a message service center which interfaces with a mobile telecommunications network for providing text information such as weather information or stock exchange information to mobile subscribers. When a mobile subscriber makes a request toward the message service center using an USSD message, the message service center provides the requested information back to the mobile terminal also via USSD messages.

An external node user 110 where a particular application module resides is responsible for the interaction (signaling procedures) towards the mobile terminal 100. The dialogue between the external node user 110 and the mobile terminal 100 is performed without the conversion of USSD components by the home location register (HLR) 120 or the mobile switching center (MSC) 130 serving the mobile terminal 100. In other words, the HLR 120 and the MSC 130 only relay the USSD components

between the concerned participants in the above dialogue (the external node user 110 and the mobile terminal 100) without modification. Whenever the MSC 130 or the HLR 120 receives a mobile terminal 100 initiated USSD request or external node user 110 initiated USSD request, it passes the request to the USSD handlers 125 and 135. The USSD handler 125 residing within the HLR 120 and the USSD handler 135 residing within the MSC 130 then perform the following tasks to invoke an application or to forward the messages to a proper application:

- analyze the syntax of the operations and protocol rules;
- identify the USSD application for incoming mobile terminal initiated USSD operations;
- forward the USSD string and the Data Coding Scheme unmodified to a local USSD application for messages originated by a mobile terminal;
- forward the USSD string and the Data Coding Scheme unmodified to a mobile terminal for outgoing messages originated by local applications; and
- generate an abort, error component or reject component upon an indication received from an USSD application.

Now referring to FIG. 2, there is shown a block diagram illustrating the data format of an USSD or SMS message 140. The first eight octets 145 are used to specify which language, operation, parameter, data length, and data sequences are being used while the remaining eighty octets 142, if needed, are used to transport character data. Because USSD and SMS are character based protocols, the contents of the eighty octet data section

142 are displayed without modification. For example, if an ASCII byte representing the letter "c" is transported to a mobile terminal, the letter "c" is displayed at the next print location on the display unit attached to the mobile terminal. Accordingly, a message service center, for example, may type a string of characters representing a text message, load the string in the eighty octet data section 142, and transmit the string over to a mobile terminal for display.

Graphic image data, on the other hand, are structured differently. To display a graphic image, a value for each point or pixel on the screen display is needed. Therefore, for a rudimentary screen of 1024 by 750 pixels (such as a fixed size screen with black and white display capability), 768,000 bits are needed to properly fill the available screen space. If the graphic image is in a standard format that will work for different size screens and different types of machines that support different numbers of characters, other additional information, such as a logical screen size, is needed. Furthermore, if the display unit has a color display capability, a color value for each position or pixel on the screen is further required. Ultimately, a binary file with a header field describing the logical screen size, logical color map, and an array of color values for the screen regions followed by actual images is needed. Also, if the resulting binary file is too large, a compression algorithm might have been used to "pack" the actual images.

An example of a binary format for representing graphic images is the Graphics Interchange Format (GIF) developed by CompuServe Incorporated. GIF is CompuServe's standard for defining generalized raster images and for formatting high-quality, high-resolution graphics to be

displayed on various graphics hardware. However, as will be discussed later, other formats are also well known in the art.

Now referring to FIG. 3, there is shown a block diagram illustrating the data format 160 of a standard GIF file. The GIF signature data section 162 specifies the GIF version number for the enclosed graphic data. The screen descriptor data section 164 specifies the overall dimensions for the logical screen that is required to display the enclosed graphic data. It further specifies the color mapping information, background screen color, and color depth information. The global color map data section 166 is optional but recommended for images requiring accurate color rendition. More specifically, the global color map data section 166 specifies color intensity for different colors within the color spectrum. The image descriptor data section 168 specifies the actual placement of the enclosed graphic data. Therefore, it specifies the start of an image in pixels from the left side of the screen, the start of the image in pixels from the top of the screen, the width of the image in pixels, and the height of the image in pixels. Lastly, the raster data 170 represents the actual image to be displayed. The format of the actual image is represented as a series of color index values. The pixels are sequentially stored from left to right for an image row. A number of image rows ultimately make up a graphic image.

An embodiment of the present invention is to transport graphic images stored in a binary data file, such as the aforementioned GIF file, to a mobile terminal by utilizing existing character based protocols such as USSD or SMS. By utilizing USSD messages, no new standard or protocol needs to be introduced or developed to

efficiently and accurately transport graphic image data to a mobile terminal. However, since the USSD transport mechanism is a character based protocol, only seven bits out of a byte (a single byte consists of eight bits) may be utilized to carry actual data. The remaining one bit is used for the USSD protocol's own purposes - such as a stop bit or start bit. As a result, the aforementioned 768,000 bits for displaying images to the 1024 by 750 pixel screen need to be divided into 109,715 bytes (768,000 divided by seven) to be encapsulated by USSD messages. Also, the header information such as the logical screen size, image descriptor, background screen color, and the graphic file format name needs to be included in the USSD message as well. After the 109,715 bytes are received by the mobile terminal, the graphic image data are extracted and converted back into its original format containing a header including screen, color, and location attributes followed by the actual arrays of graphic images.

FIG. 4 is a block diagram illustrating the overview layout of the conversion process of encapsulating binary graphic image data into USSD messages. As described previously, a stream of binary data within a GIF file 160 are divided up via groups of seven bits 176 and individually reformatted to eight bit bytes 150. The remaining one bit is used for USSD purposes. The reformatted bytes 150 are then encapsulated using USSD messages 140. Within each USSD message, the header 145 indicates which destination and application module need to receive this character data, and the string section 142 encapsulates the formatted character data. If the GIF file 160 is too large for a single USSD message, a number of USSD messages, as needed, are utilized to separately

transport the binary graphic image data. Once the mobile terminal receives the USSD messages 140, the encapsulated character data are extracted and reconverted to the original GIF file 160. During the process of conversion, appropriate header information 174 and the actual image data 172 for the original GIF file are reassembled.

Accordingly, reference is now made to FIG. 5 where, in accordance with the teachings of the present invention, an USSD message 140 is shown encapsulating a GIF file 160 (or part of a GIF file) which has been converted to character based data. As described above, by splitting up arrays of bit data into 7-bit character data to enable the contents of the GIF file 160 to be compatible with a character based carrier, such as the USSD message 140, the USSD string section 142 can be utilized to transport converted graphic images 160 without requiring a different transportation mechanism or protocol.

FIG. 6 is a block diagram illustrating a server application transmitting graphic images to a client application in accordance with the teachings of the present invention. The server application module 200 is responsible for converting graphic images along with header information into character base data and for transmitting them over to the client application module 200 residing within a mobile terminal. The server application 200 can internally store the subscriber requested information via a database, or it can receive the requested information externally as illustrated by a line 240 representing a graphic image received from, for example, a fax machine. Accordingly, the reception function module 210 within the server application module 200 receives the user requested information from external

nodes or retrieves it from internal storage sources, and passes it to the conversion function module 220.

The conversion function module 220 takes the graphic image data file, such as a GIF file, and converts the stored binary data along with header information into character based data as described previously. It further loads the converted binary data into a number of USSD messages as necessary to transport the whole GIF file. The USSD messages encapsulating the converted GIF binary data are then sent to the sending function module 230 to be transported to the client application module 300. As described in FIG. 1, these USSD messages are then sent to an USSD handler residing within an HLR or MSC to be physically transported to a mobile terminal. These USSD messages are physically transported separately from the traffic channel (TCH) utilizing a control channel such as Stand-alone Dedicated Control Channel (SDCCH).

Once the transmitted USSD messages are received by the mobile terminal, an USSD handler residing within the mobile terminal forwards the messages to the client application module 300. The reception function module 330 within the application module 300 intercepts the received USSD messages and extracts the encapsulated graphic image data. The extracted data are then sent to the conversion function module 320 which in turn reconverts the character based data back to the original GIF data. This is performed by extracting the seven bit data from an eight bit byte, and rearranging them to represent the original arrays of bit data.

While converting the extracted data, the conversion function module 320 first needs to ascertain the format of the encapsulated graphic file. Graphic file formats include, but not limited to:

- GIF: Graphics Interchange Format;
- JPEG: Joint Photographics Expert Group;
- ACR: ACR-NEMA medical image file;
- BMP: Bitmap format file;
- PCX: Paintbrush picture format;
- CGM: Computer Graphics Metafile;
- HDF: Hierarchical Data Format;
- P3D: Pittsburg Supercomputing Center 3D Metafile;
- RTF: Rich Text format;
- MPEG: Motion Pictures Expert Group
- FLI: Animation file format.

The conversion function module needs to know which graphic format is used to properly convert the header information along with the rest of the graphic data properly. The variations and number of graphic formats, as illustrated above, are not limited to the aforementioned list. As long as the conversion function module 220 residing within the server application 200 and the conversion function module 320 residing within the client application 300 are in agreement to recognize each other's converted data, any format can be utilized. After ascertaining the current graphic file format, the extracted data are converted accordingly back to their original data format.

The reconverted GIF or graphic image data are then sent to the user application function module 310 to be displayed on to a display unit 340 attached to or within the mobile terminal. The user application function module 310 might accomplish this display task by feeding the GIF data to a video graphics array (VGA) driver 342 associated with the display unit 340.

The client application module 300 needs to physically reside within the mobile terminal 100 in order to accept,

convert, and display graphic images. On the other hand, the server application module 200 can reside within a number of different nodes within a mobile telecommunications network. FIG. 7 is a block diagram illustrating a server application 200 residing within a MSC 130 serving a particular mobile terminal 100. The server application module 200 residing within the MSC 130 retrieves or receives the user requested graphic images, and converts the binary data representing the graphic images to USSD compatible character based data. As described in FIG. 6, such converted data are then loaded onto USSD messages and sent to an USSD handler within the MSC 130. The MSC 130 in turn transmits the USSD message to the base station controller 310. The base station controller 310 ascertains the particular base station 300 covering the cell area currently occupied by the mobile station 100, and transmits the USSD message to that particular base station 300. The base station 300 then transmits the USSD message to the mobile terminal 100 over a non-traffic communications channel such as Stand-alone Dedicated Control Channel (SDCCH). SDCCH is one of the control channels provided by the GSM or PCS network system utilizing the Time-Division Multiple Access (TDMA) technology and is normally used for system signaling during a call set-up before allocation of a traffic channel (TCH). For example, subscriber registration and authentication take place via SDCCH. Once the mobile terminal 100 receives the USSD message, the USSD handler within the mobile terminal 100 reviews the USSD header information associated with the received USSD message and determines which application needs to receive the message. As a result, the client application module 310 is forwarded the USSD message, and in accordance with the

teachings of the present invention, the character based data are extracted and reconverted back to its original binary data format. The reconverted binary data, such as a GIF file, are then input into a VGA driver to be displayed onto a LCD unit. By utilizing SDCCH instead of a traffic channel (TCH), the mobile terminal 100 is capable of displaying graphic images on a LCD unit while the subscriber is simultaneously involved in a conversation with another telecommunications user.

Reference is now made to FIG. 8 where a block diagram illustrating a server application 200 residing within a home location register (HLR) 120 serving the mobile terminal 100 is shown. As mentioned previously, the server application module 200 can be associated with a number of different nodes within a mobile telecommunications network. For network originated USSD operations, they follow the similar procedures for transmitting graphic images as described in FIG. 7. One difference is that the conversion and encapsulation are performed within the server application module 200 located within the HLR 120 instead of the MSC 130. However, for mobile terminal 100 initiated operations, messages are forwarded to the MSC 130 via the path of the mobile terminal 100 to the base station 300 to the base station controller 310 to the MSC 130. The MSC 130 then looks at the header information associated with the received USSD message and determines that the specified application is not recognized. As a result, the MSC 130 transmits the unrecognized USSD message to the HLR 120. The HLR 120 then determines that the application specified by the header resides within the HLR 120 itself, and forwards the USSD data to the server application module 200. Subsequently, the server application module 200 ascertains

and performs the user request contained within the received USSD data. Such a request, for example, may be for a graphic representation of a local map or area. The server application module 200 accordingly retrieves the information internally or receives them from an external source, and transmits the requested graphic image back to the mobile terminal 100 as explained above.

Reference is now made to FIG. 9 where a block diagram illustrating a server application module 200 residing within an external node 400 connected to a home location register 120 serving a mobile terminal 100 is shown. For network originated USSD operations, they follow the similar procedures for transmitting graphic images as described in FIG. 8. One difference is that the conversion and encapsulation are performed within the server application module 200 located within the external node 400 instead of the HLR 120. The USSD handlers residing within the HLR 120 and the MSC 130 transparently handle and route the USSD messages generated by the external node 400. For mobile terminal 100 initiated operations, messages are forwarded to the MSC 130 via the path of the mobile terminal 100 to the base station 300 to the base station controller 310 to the MSC 130. The MSC 130 again looks at the header information associated with the received USSD message and determines that the specified application is not recognized. The MSC 130, in turn, transmits the unrecognized USSD message to the HLR 120. The HLR 120 also looks at the header information associated with the received USSD message and subsequently determines that the specified application also does not reside within the HLR 120 itself. The HLR 120 further transmits the USSD message to the external node 400 that is associated with the HLR 120. The external node 400

lastly looks at the header information specified by the received USSD message and forwards it to the server application module 200 residing within the external node 400 for execution. As described previously, the server application then ascertains and properly performs the user request contained within the received USSD data.

Although a preferred embodiment of the method and apparatus of the present invention has been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

WHAT IS CLAIMED IS:

1. A system for communicating binary data representing a graphic image between a first node and a second node within a mobile telecommunications system, said system comprising:

a server application module associated with said first node, said server application module comprising:

a first conversion function module for formatting said binary data to character based data; and

a sending function module connected to said first conversion function module for transmitting said formatted character based data to said second node;

a client application module associated with said second node, said client application module comprising:

a first reception function module for receiving said formatted character based data; and

a second conversion function module connected to said first reception function for reconverting said character based data to said binary data representing said graphic image; and

a digital communications link for communicating messages containing character based data from said first node to said second node.

2. The system of claim 1 wherein said sending function module loads said converted character based data into said messages and communicates over said digital communications link.

3. The system of claim 1 wherein said first reception function module receives said messages

containing said converted character based data over said digital communications link.

4. The system of claim 3 wherein said client application module further comprises an application function module for displaying said binary data.

5. The system of claim 1 wherein said graphic images are stored in a Graphic Interchange format (GIF) file.

6. The system of claim 1 wherein said server application module is located within a mobile switching center (MSC).

7. The system of claim 1 wherein said server application module is located within a home location register (HLR) associated with a mobile switching center serving said second node.

8. The system of claim 1 wherein said server application module is located within an external node connected to a home location register serving said second node.

9. The system of claim 1 wherein said client application module is within a mobile terminal.

10. The system of claim 1 wherein said server application module further comprises a second reception function module for receiving said binary data from an external node.

11. The system of claim 1 wherein said messages comprise Unstructured Supplementary Services Data (USSD) formatted messages.

12. The system of claim 1 wherein said messages comprise Short Messages Service (SMS) formatted messages.

13. The system of claim 1 wherein said digital communication link comprises a Stand-alone Dedicated Control Channel (SDCCH).

14. A method of communicating binary data representing a graphic image from a mobile telecommunications network to a mobile terminal associated with said mobile telecommunications network, said method comprising the steps of:

loading said binary data representing said graphic image into a character based message signal;

transmitting said character based message signal to said mobile terminal; and

extracting said binary data representing said graphic image for display.

15. The method of claim 14 wherein said step of loading further comprises the steps of:

formatting said binary data within said mobile telecommunications network into a character based format; and

loading said character based formatted data into said character based message signal.

16. The method of claim 15 wherein said step of formatting said binary data further comprises the step of

formatting said binary data to character data compatible with an Unstructured Supplementary Services Data (USSD) format.

17. The method of claim 15 wherein said step of formatting said binary data further comprises the step of formatting said binary data to character data compatible with a Short Message Service (SMS) format.

18. The method of claim 14 wherein said step of extracting further comprises the step of reformatting said character based formatted data to said binary data representing said graphic image.

19. The method of claim 14 wherein said step of transmitting further comprises the step of transmitting said character based message via a non-traffic digital communications channel.

20. The method of claim 19 wherein said step of transmitting further comprises the step of transmitting said character based message via a Stand-alone Dedicated Control Channel (SDCCH).

21. The method of claim 15 wherein said binary data representing said graphic images comprise a Graphic Interchange Format (GIF) file.

22. A mobile terminal for displaying graphic images received from a mobile switching center (MSC) within a mobile telecommunications network, said mobile terminal comprising:

a reception module for receiving from said MSC messages encapsulating character based data;

a conversion module for converting said character based data to binary data representing said graphic image; and

an application module for displaying said binary data representing said graphic image on a display attached to said mobile terminal.

23. The mobile terminal of claim 22 wherein said reception module is connected to receive said messages via a non-traffic digital communications channel.

24. The mobile terminal of claim 23 wherein said non-traffic digital communications channel comprises a Stand-alone Dedicated Control Channel (SDCCH).

25. The mobile terminal of claim 22 wherein said messages comprise Unstructured Supplementary Services Data (USSD) formatted messages.

26. The mobile terminal of claim 22 wherein said messages comprise Short Message Service (SMS) formatted messages.

27. The mobile terminal of claim 22 wherein said application module further comprises a graphic interface driver module for displaying said binary data representing said graphic images.

28. The mobile terminal of claim 22 wherein said binary data are formatted according to a Graphic Interchange Format (GIF).

29. A system for communicating binary data representing a graphic image from a mobile telecommunications system to a mobile terminal associated with said mobile telecommunications system, said system comprising:

means for formatting said binary data within said mobile telecommunications system into a character based format;

means for loading said character based formatted data into a character based message;

means for transmitting said character based message to said mobile terminal; and

means for reformatting said character based formatted data back from said message to said binary data for displaying said graphic image.

30. The system of claim 29 wherein said means for formatting further comprises means for formatting said binary data to character data compatible with an Unstructured Supplementary Services Data (USSD) format.

31. The system of claim 29 wherein said means for formatting further comprises means for formatting said binary data to character data compatible with a Short Message Service (SMS) format.

32. The system of claim 29 wherein said means for transmitting further comprises means for transmitting said character based message via a non-traffic digital communications channel.

33. The system of claim 32 wherein said non-traffic digital communications channel comprises a Stand-alone Dedicated Control Channel (SDCCH).

34. The system of claim 29 wherein said binary data representing said graphic images are formatted in accordance with a Graphic Interchange Format (GIF).

35. The system of claim 29 wherein said means for receiving is located within a mobile switching center (MSC) serving said mobile terminal.

36. The system of claim 29 wherein said means for receiving is located within a home location register (HLR) associated with a mobile switching center serving said mobile terminal.

37. The system of claim 29 wherein said means for receiving is located within an external node connected to a home location register serving said mobile terminal.

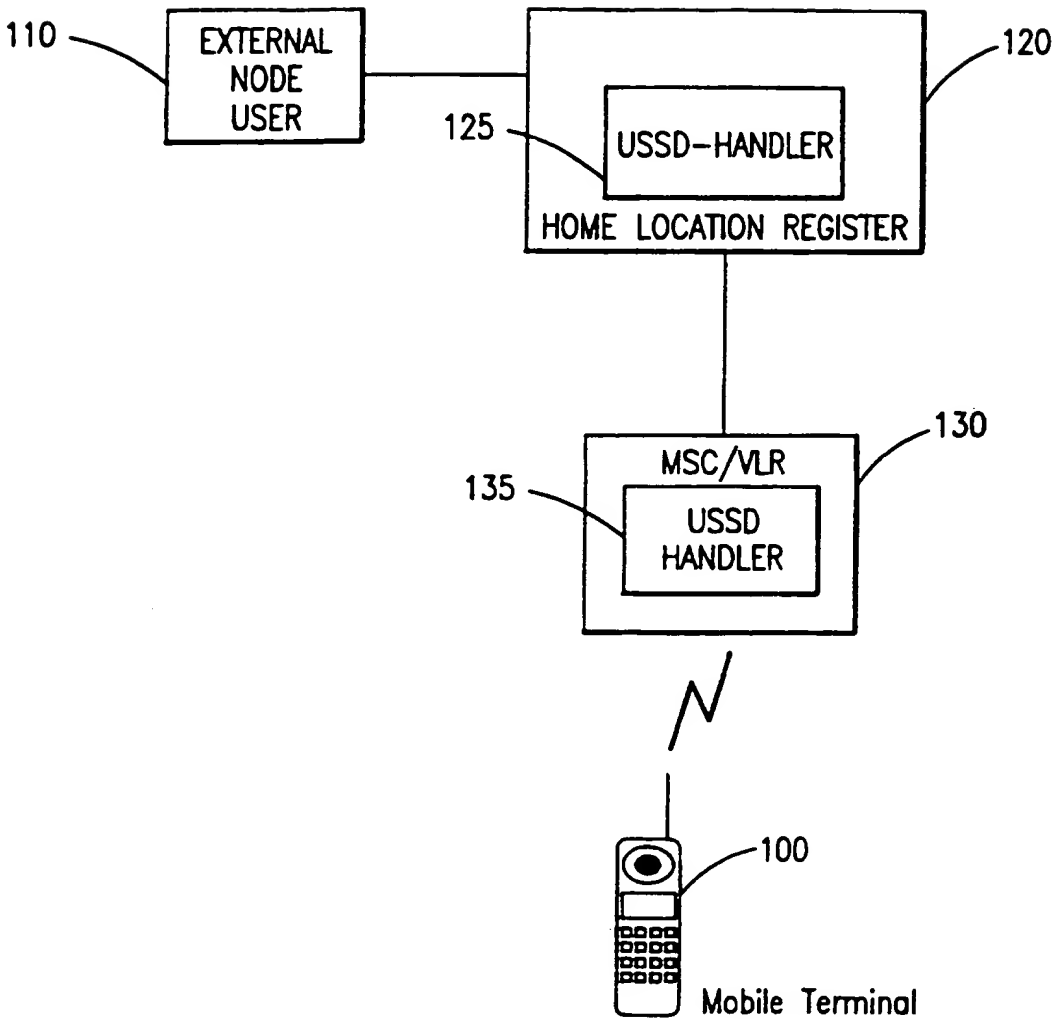
110
EXTERNAL NODE USER
120
125
USSD-HANDLER
HOME LOCATION REGISTER
130
MSC/VLR
135
USSD HANDLER
100
Mobile Terminal

FIG. 1

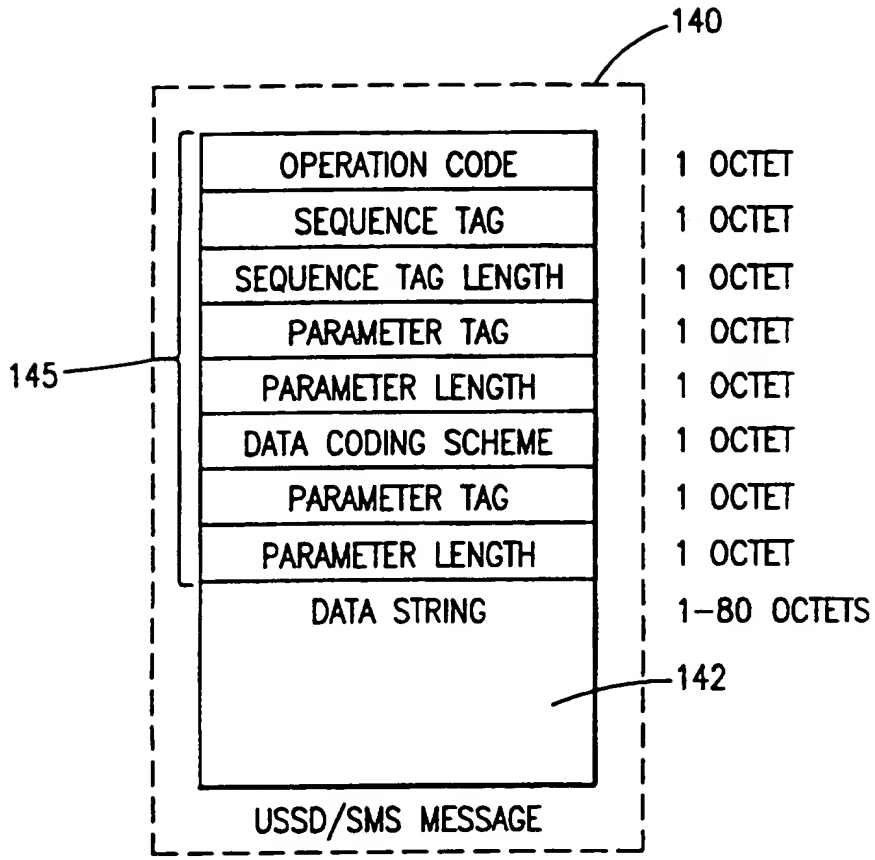
140
OPERATION CODE
SEQUENCE TAG
SEQUENCE TAG LENGTH
PARAMETER TAG
PARAMETER LENGTH
DATA CODING SCHEME
PARAMETER TAG
PARAMETER LENGTH
DATA STRING
USSD/SMS MESSAGE
145
142
1 OCTET
1 OCTET
1 OCTET
1 OCTET
1 OCTET
1 OCTET
1 OCTET
1 OCTET
1–80 OCTETS

FIG. 2

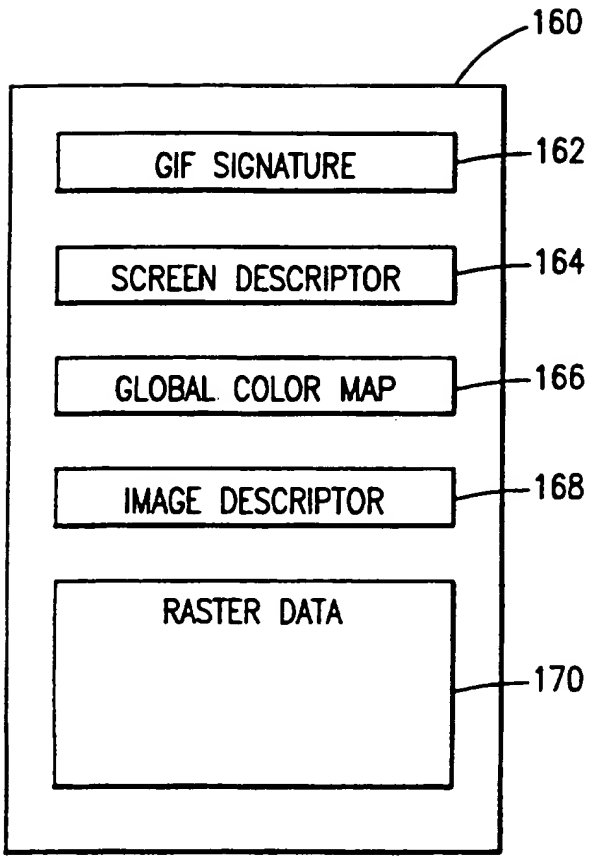
160
GIF SIGNATURE
162
SCREEN DESCRIPTOR
164
GLOBAL COLOR MAP
166
IMAGE DESCRIPTOR
168
RASTER DATA
170

FIG. 3

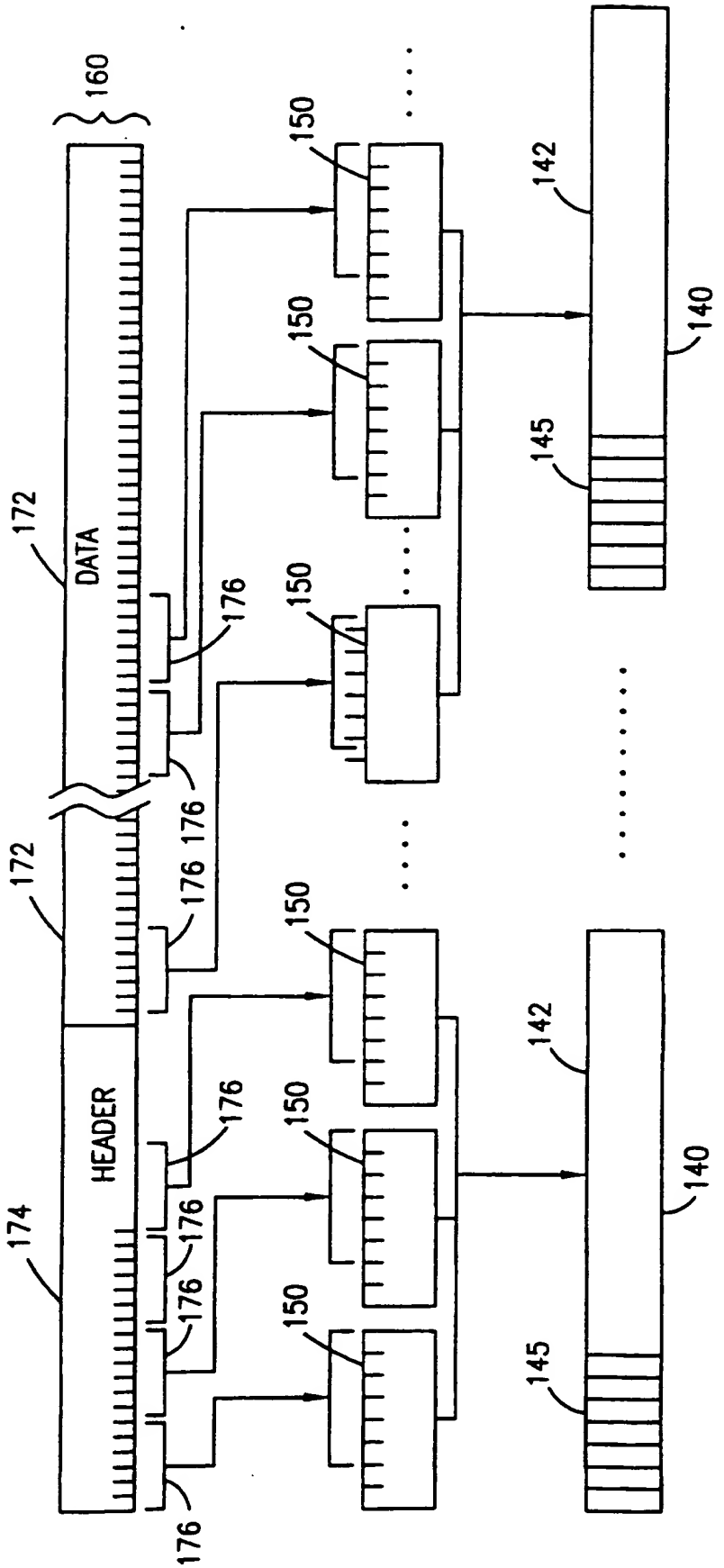

FIG. 4

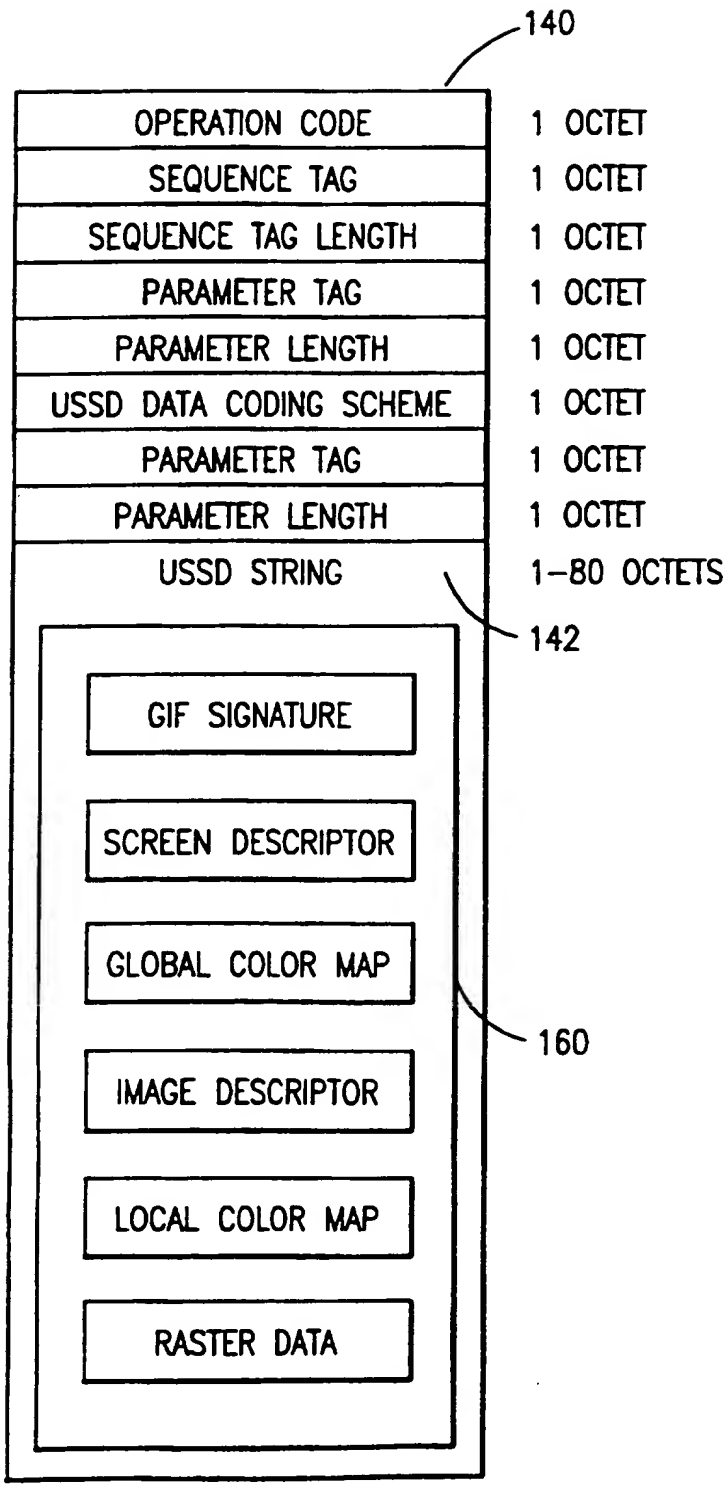
140
OPERATION CODE
1 OCTET
SEQUENCE TAG
1 OCTET
SEQUENCE TAG LENGTH
1 OCTET
PARAMETER TAG
1 OCTET
PARAMETER LENGTH
1 OCTET
USSD DATA CODING SCHEME
1 OCTET
PARAMETER TAG
1 OCTET
PARAMETER LENGTH
1 OCTET
USSD STRING
1–80 OCTETS
142
GIF SIGNATURE
SCREEN DESCRIPTOR
GLOBAL COLOR MAP
IMAGE DESCRIPTOR
LOCAL COLOR MAP
RASTER DATA
160

FIG. 5

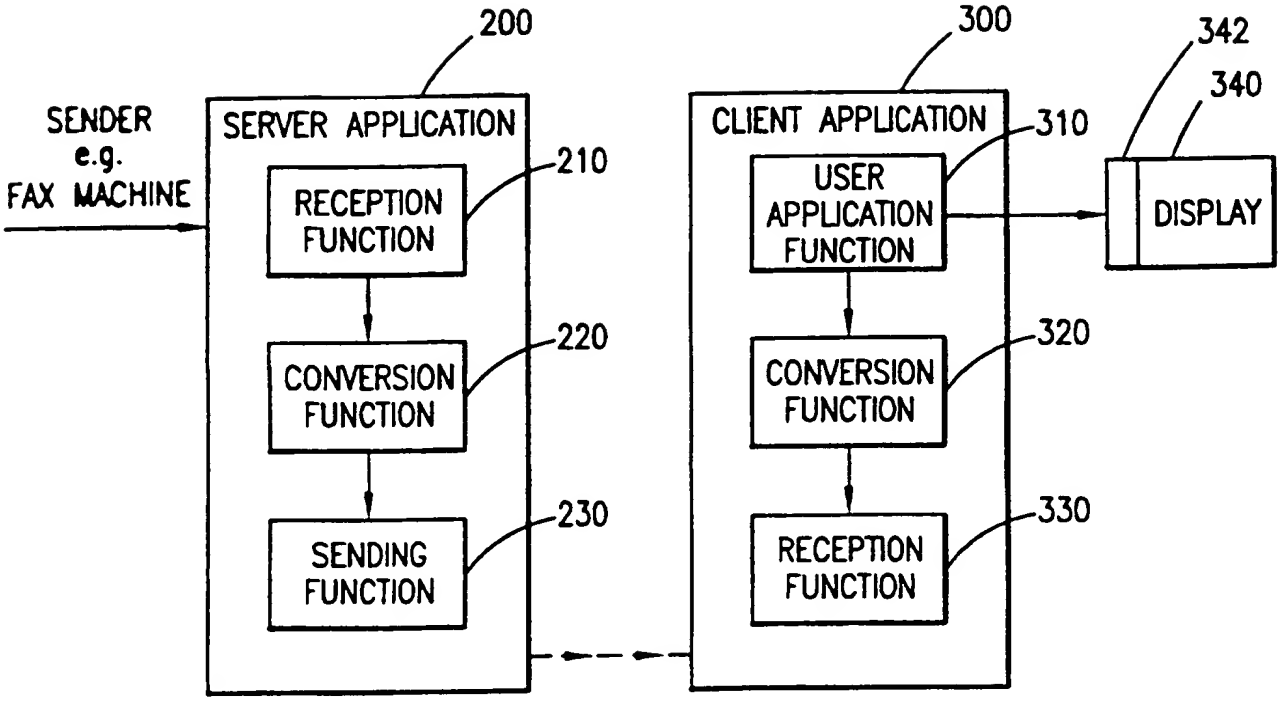
200
SERVER APPLICATION
SENDER
e.g.
FAX MACHINE
RECEPTION FUNCTION
210
CONVERSION FUNCTION
220
SENDING FUNCTION
230
300
CLIENT APPLICATION
310
USER APPLICATION FUNCTION
CONVERSION FUNCTION
320
RECEPTION FUNCTION
330
342
340
DISPLAY

FIG. 6

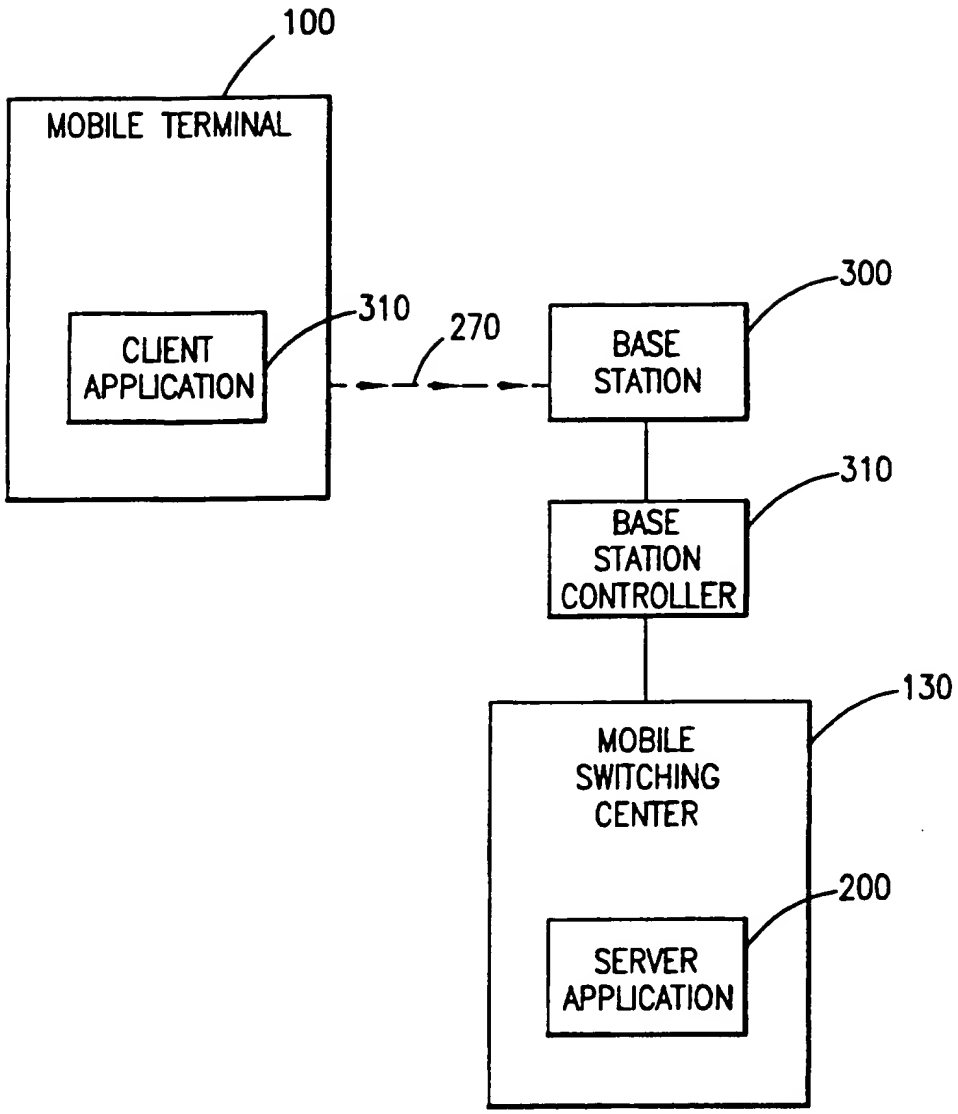
100
MOBILE TERMINAL
CLIENT APPLICATION
310
270
300
BASE STATION
310
BASE STATION CONTROLLER
130
MOBILE SWITCHING CENTER
200
SERVER APPLICATION

FIG. 7

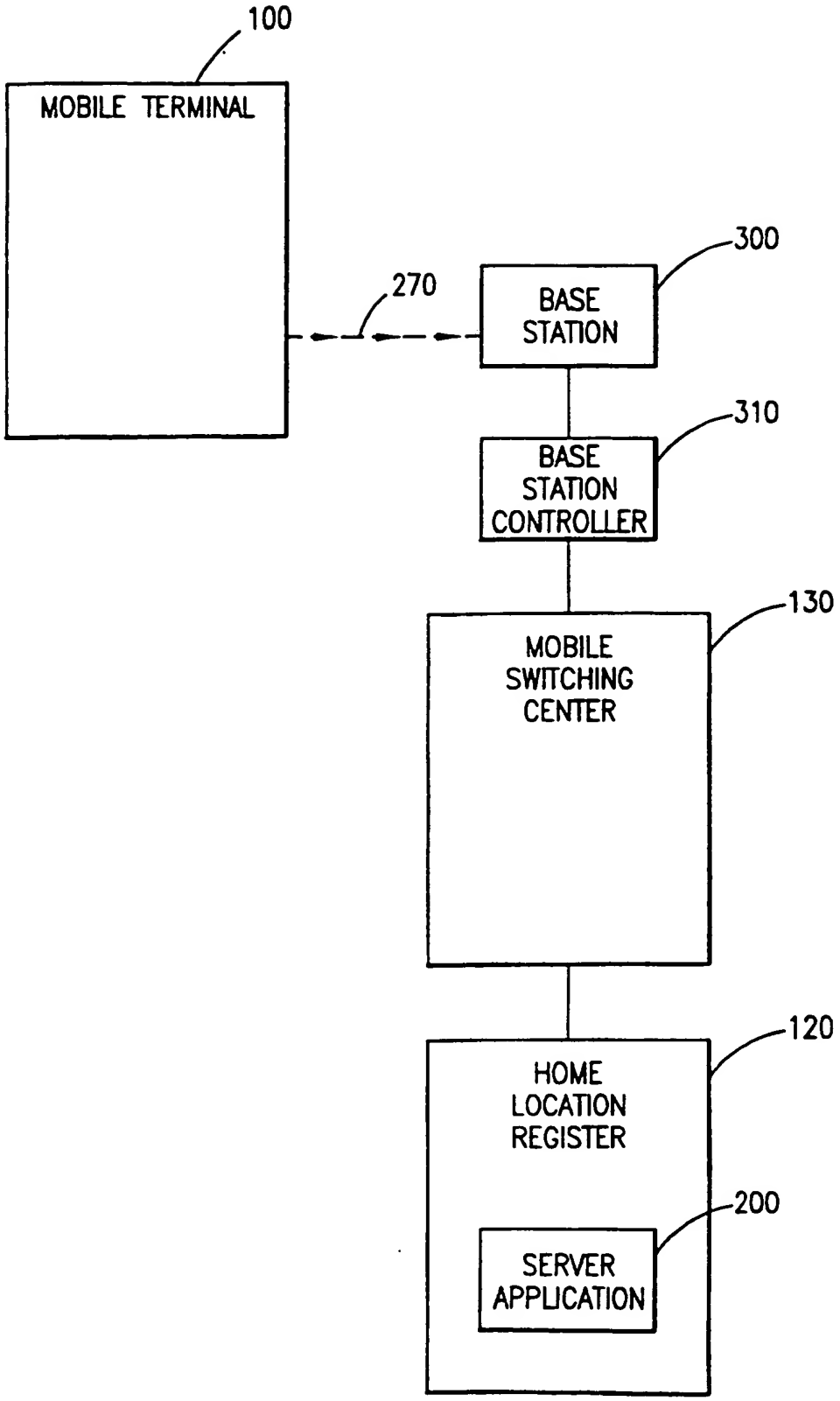
100
MOBILE TERMINAL
270
300
BASE STATION
310
BASE STATION CONTROLLER
130
MOBILE SWITCHING CENTER
120
HOME LOCATION REGISTER
200
SERVER APPLICATION

FIG. 8

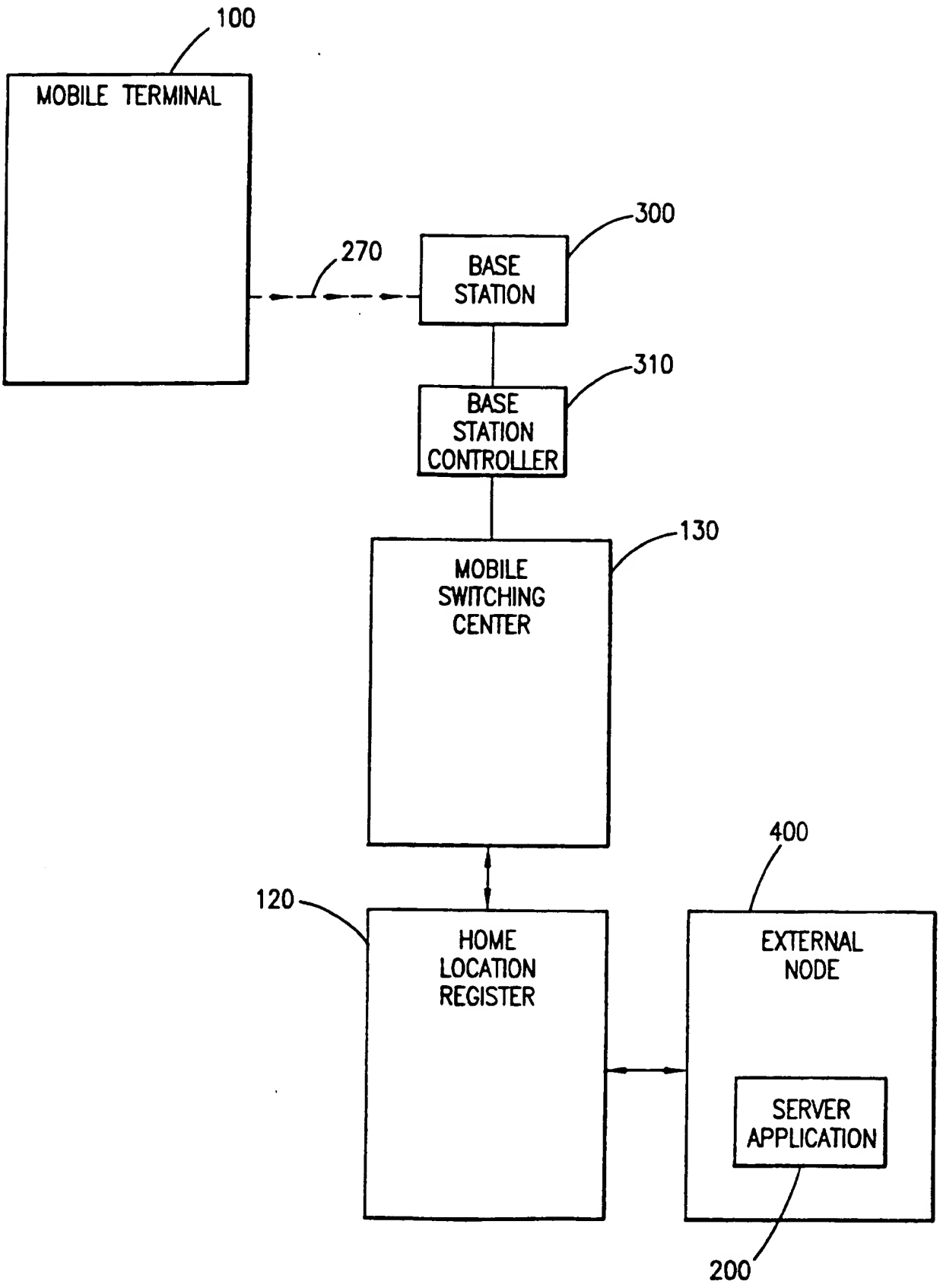
100
MOBILE TERMINAL
270
300
BASE STATION
310
BASE STATION CONTROLLER
130
MOBILE SWITCHING CENTER
400
120
HOME LOCATION REGISTER
EXTERNAL NODE
SERVER APPLICATION
200

FIG. 9

PCT

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International Bureau

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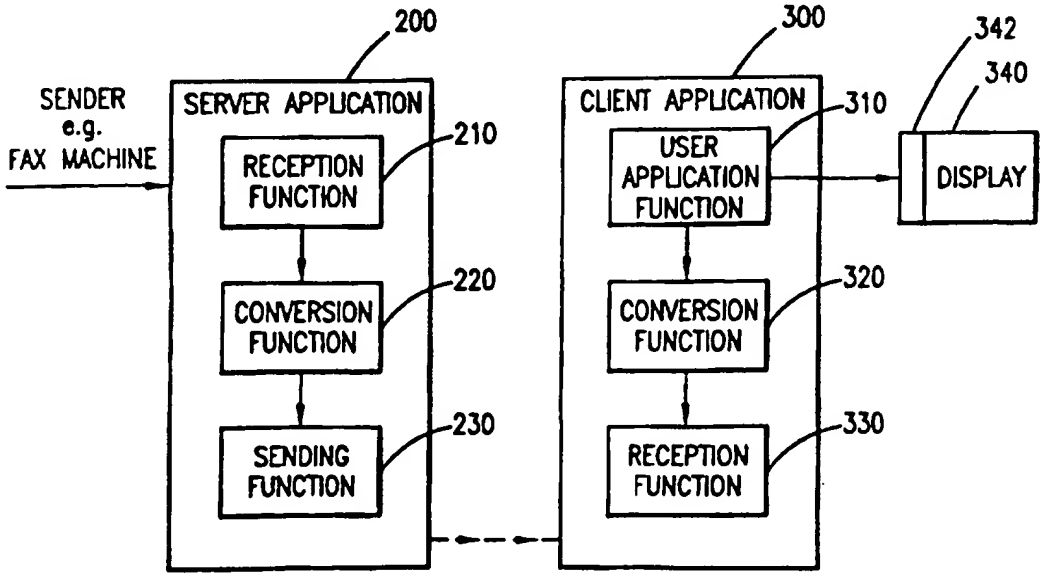

(57) Abstract

Binary data representing graphic images, such as a Graphics Interchange Format (GIF) file, are converted into character based data. The converted character based data are then loaded onto an Unstructured Supplementary Service Data (USSD) message and transported to a mobile terminal via Stand-alone Dedicated Control Channel (SDCCH) provided by the Global System for Mobile (GSM) or Personal Communications System (PCS) network. Once the transmitted USSD message containing the converted character based data are received by the mobile terminal, the encapsulated data are retrieved and reconverted back to the binary data representing the original GIF file. The GIF file is then fed into a video graphics array (VGA) driver to be displayed on a liquid crystal display (LCD) unit attached to the mobile terminal.

INTERNATIONAL SEARCH REPORT

In ional Application No
PCT/US 97/02328

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 446 678 A (SALTZSTEIN WILLIAM E ET AL) 29 August 1995 see abstract see column 2, line 6 - line 15 see column 1, line 45 - line 63	1-4,9, 14,15, 18,29
Y	see figure 3	12,17, 19,22, 23,26, 27,31,32

Y	NTZ NACHRICHTENTECHNISCHE ZEITSCHRIFT, vol. 47, no. 8, August 1994, pages 558-560, 562/563, XP000468529 FOELLING W F: "MOBILE DATEN- UND TELFAXUEBERTRAGUNG IN GSM-NETZEN" see figure 1 see the whole document	12,17, 19,22, 23,26, 27,31,32

☐ Further documents are listed in the continuation of box C.

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7 August 1997	25.08.97

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